

## State of the world's plants and fungi

Antonelli, A et al (2020) *State of the World's Plants & Fungi 2020*. Royal Botanic Gardens, Kew.  
DOI: <https://doi.org/10.34885/172> (open access), 100 pp.

Professor Alexandre Antonelli, Director of Science, Royal Botanic Gardens, Kew introduces this major online report with the aim that it "tackles the knowledge gaps and unlocks the known and potential benefits of fungi and plants for us and our planet. Drawing upon the expertise of 210 researchers in 97 institutions across 42 countries, this unparalleled collaborative effort, generously funded by the Sfumato Foundation, aims to tell the world where we might find solutions to the challenges we face. Although there is no single or easy way out of the environmental crisis, the relevance of plant and fungal science cannot be understated. This is the fourth report in Kew's *State of the World's* series, which focused on plants in 2016 and 2017, and fungi in 2018. This is the first time that plants and fungi have been combined in one report, to highlight their intrinsic links and joint benefits."

Although this report has a very broad remit and is not focused on succulents, these plants feature throughout and a few are illustrated in high quality photos, such as the

stunning frontispiece of a *Selenicereus*. There are many hugely important big messages here, from which I can only select a few highlights. The report is written in accessible language and is open access, so I encourage all BCSS members to take a look at it.

The four main sections of the report, comprising 12 chapters, are: Revealing new insights, Unlocking useful properties, Using biological resources wisely, and Quantifying biodiversity. In the first of these, a subsection considers calculating extinction risk for plants and fungi where important focus is on the threats to plants and their causes. Here a shocking headline states that "2 in 5 plants are estimated to be threatened with extinction". I have extracted the data from Figure 1 on page 12, and present it as Table 1.

Table 1 Why plant species are at risk

%	The major threats to plants
32.8	Agriculture and aquaculture
21.1	Biological resource use
10.8	Natural system modifications
10.5	Residential and commercial development
6.5	Invasive and other problematic species, genes and diseases
5.4	Energy production and mining
4.1	Climate change
3.2	Other human disturbance
5.5	Others, including transportation and geological events

To summarise these data, the greatest threats, the first four coloured green in the figure, account for 75% of the total. In contrast, there has been significant media publicity about plant poaching and the collection of succulents from habitat. The data in this table indicate that 'other human disturbance', which includes poaching and collecting, accounts for just 3.2% of the threats. I should emphasise that these data relate to ALL plants, such that a particular threat may be far more significant for a specific plant group. Of note is the statement (accompanied by an excellent habitat photo of saguaros) that "the Red List [of endangered species published by the IUCN] over-represents families targeted by assessment programmes, such as the cactus family (Cactaceae)".

A brief word about fungi. These organisms form their own Kingdom since they have unique life forms and function quite distinct from animals, plants and bacteria. For example, like animals they do not photosynthesise and

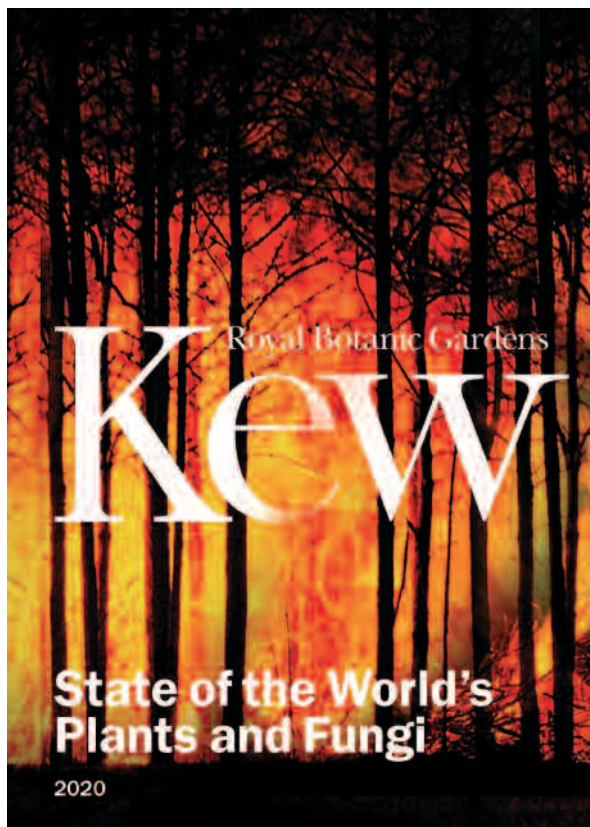


Fig. 1 Front page of the online report



hence require preformed organic carbon compounds to provide their energy sources. Consequently fungi are major decomposers of plant material, such that huge trees are broken down to their constituent molecules largely as a result of fungal action. They are therefore major players in removing plant waste such as leaf litter and in producing compost. A small number of fungi are also parasites and cause many plant diseases such as soft rots and mildews, etc. Finally, an underrated activity is that many fungi interact with plant roots to form what has been termed a 'wood-wide web'. These are symbiotic associations in which both partners benefit. Plants provide carbon compounds and hence energy to the fungi, who in return are efficient scavengers, providing the plants with water and essential mineral nutrients. Many plants such as the many thousands of species of orchids, perform very poorly without their specific fungal partners. The most studied fungi-plant root interactions are those of trees, known as mycorrhizae, in which the fungi either live on root surfaces or actually invade the roots forming even closer interconnections. It is likely that all trees form these associations. There have been few studies of how succulent plant roots interact with fungi, but it seems highly likely that every species of succulent has specific interactions with soil-inhabiting fungi.

Finally, Antonelli ends his introduction with the optimistic note that "Our challenges may be large, but as long as plants and fungi remain there is hope and opportunity."

Colin C Walker

Further reading:

<https://nph.onlinelibrary.wiley.com/toc/25722611/2020/2/5>

## Huernia from Tigray, Ethiopia

I read with great interest Trevor Wilson's article on succulents in Tigray, Ethiopia in the September 2020 issue of *CactusWorld* (38(3): 171–182). There is a photo on page 181 with the caption 'Unidentified succulent (probably *Huernia macrocarpa*) ...'. I can confirm that it is indeed *Huernia macrocarpa* subsp. *macrocarpa*.

I found this plant too, in the city of Mekelle (capital of Tigray) on the slope of the hill below the campus of Mekelle



Fig. 2 Clump of *H. macrocarpa* subsp. *macrocarpa* near Mekelle university (Photo: Rene Samek)



Fig. 3 Flower of *H. macrocarpa* subsp. *macrocarpa* near Mekelle University (Photo: Rene Samek)



Fig. 4 *H. macrocarpa* subsp. *macrocarpa* with unicoloured dark-red flower, SE Corbetá, Tigray, Ethiopia (Photo: Jiří Hadamovský)

University in 2012, and while searching for its identity I came across M G Gilbert's article 'The Genus *Huernia* in Ethiopia', published in the *Cactus and Succulent Journal* (US) in 1975. There Gilbert provides photos and description of all five taxa of *Huernia* growing in Ethiopia as well as a map of their distribution. He treated *Huernia macrocarpa* as a species with two subspecies in Ethiopia:



Fig. 5 *H. macrocarpa* subsp. *macrocarpa* with bicoloured flower, SE Corbetá, Tigray, Ethiopia (Photo: Jiří Hadamovský)



subsp. *macrocarpa* (under which he put the former *Huernia penzigii* N.E.Brown with its varieties *schimperii* and *schweinfurthii*) and subsp. *concinna* – formerly *Huernia concinna* N.E.Brown. A further taxon, *Huernia macrocarpa* var. *arabica* from the Arabian Peninsula was also described by N E Brown.

*Huernia macrocarpa* subsp. *macrocarpa* can have both unicoloured dark-red or reddish-brown flowers and bicoloured whitish flowers with concentric reddish-brown stripes, while subspecies *concinna* has bicoloured flowers with either concentric reddish-brown stripes or reddish-brown dots. The main difference between the two subspecies is geographical distribution and the smoothness of the exterior of the corolla. Subspecies *macrocarpa* grows in Tigray and the neighbouring Wello region to the south, while subsp. *concinna* grows in the Harergie region, quite far from Tigray in a south-eastern direction. The flowers of subsp. *macrocarpa* are papillate while the flowers of subsp. *concinna* are smooth.

Jiří Hadamovský, a Czech stapeliad specialist, has kindly provided some photos of plants in his collection.

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## What is *Drimiopsis* 'purpurea'?

For almost 20 years there has circulated in cultivation a very attractive bulbous plant under the misapplied name of *Drimiopsis purpurea*. It is currently widely available on the Internet and numerous illustrations display cultivated plants around the world from Japan to America, Europe and southern Africa.

One of the sources for cultivation was the late Charles Craib who, along with Pearl Lebacha, collected plants he provisionally called *Drimiopsis purpurea* in South Africa from the Pietersburg area, near Houtboschdorp, in open savannah during a field trip in 1998. In turn, he sent bulbs to Roy Mottram, then proprietor of Whitestone Nursery. Subsequently, Roy built up a small stock and distributed bulbs to customers. Craib may also have sent bulbs to other nurseries or growers, and at any rate it is now globally available.

Investigation of the name *Drimiopsis purpurea* reveals it is a synonym of *Drimiopsis atropurpurea* N.E.Brown that was illustrated in *Flowering Plants of Africa* in 1946 as *D. purpurea* (van der Merwe, 1946) (Fig. 6). Comparison of this illustration with the live plants in cultivation (Fig. 7) reveals several differences. *Drimiopsis atropurpurea* was named for the dark purple colour of its flowers rather than blotches on its unmarked leaves, moreover it is pilose whereas our cultivated plant is glabrous, and has greenish flowers and strongly spotted leaves with a distinctive crenulated margin. Clearly, it is not the same as *D. atropurpurea*.

This distinctive plant remained unnamed until the revision of *Drimiopsis* by Pearl Lebacha (2004), who provided the manuscript name *D. kikiae*. In view of its widespread cultivation and popularity, a valid name is needed. Unfortunately, names published in theses are regarded as unpublished under the botanical code (ICN Art. 30.9), hence it is validated here.

*Drimiopsis kikiae* P.D.Lebatha sp. nov.

**Plants** medium-sized (10–15cm high); protantherous to synantherous; annual; bulbaceous. **Bulbs** hypogeal, gregarious, non-stoloniferous, whitish, roundish, 1–3cm across. Bulb scales loosely packed, when torn without threads, outer scales white and fleshy. **Leaves** 2–3 or more, erect, cordiform, lanceolate, (4–)8–12(–18)cm long and 24cm wide, when torn without threads, pseudopetiole. Pseudopetiole much shorter than lamina, tinted. Leaf margin crenate, noncartilaginous, bordered purple/brown. **Lamina** glabrous, thick, spotted adaxially, abaxially tinted purple. Leaf apex acuminate, base attenuate, tinted dark purple. **Inflorescence** 1–2 per bulb, simple, sparse erect raceme, more or less as long as leaves. Rachis conical, 8–10cm long. Peduncle spotted. Bracts in mature inflorescence vestigial. Prophylls absent. **Flowers** 16–30, minute (1–2mm long), shortly pedicellate (0.14cm long), actinomorphic, campanulate, hypanthium base rounded. **Tepals** 6, dimorphic, creamy-brownish, hypanthium inconspicuous, outer whorl of tepals connivent, longitudinally cucullate, apically conduplicate; inner whorl of tepals connivent, longitudinally cucullate, apically conduplicate. **Stamens** 6, greenish to whitish, erect, epitepalous, uniseriate, inserted at throat of perianth tube, as long as pistil. **Filaments** valvate, deltoid to acuminate. **Anthers** dorsifixed. **Gynoeceum** tricarpetate, ovules two per locule. **Stigma** roundish; papillae sessile, trilobal. **Style** shorter than ovary; terete. **Ovary** sessile, globose, transversely smooth, whitish-green, shoulders absent. Nectaries present.

**Type:** South Africa, Louwsburg, Itala Nature Reserve under trees and hidden in grasses, *Lebacha* 045 (PUC holotype; PRE isotype).

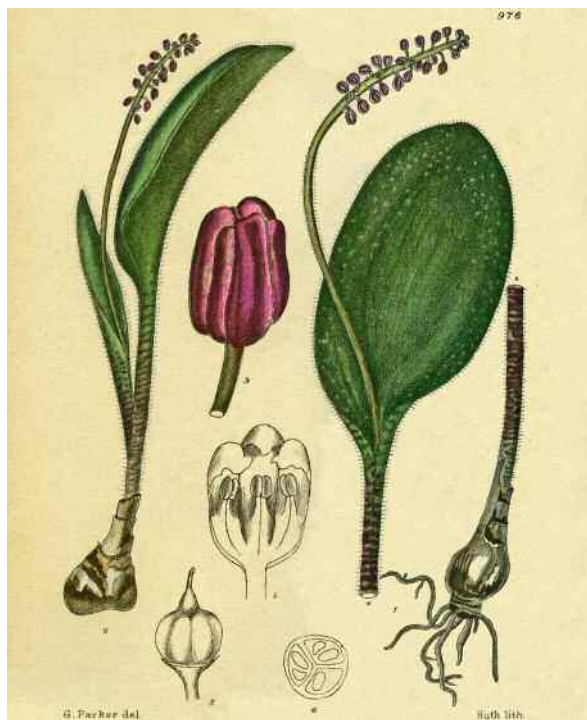


Fig. 6 *Drimiopsis purpurea*. *Fl.Pl.Afr.* 25(1) t.976





Fig. 7 *Drimiopsis kikiae* (Photo: Roy Mottram)

**Distribution and habitat preference:** *Drimiopsis kikiae* is known only from the Itala Nature Reserve, Louwsburg, South Africa, in moist shaded areas under trees and rocks. Flowering time September to December.

**Diagnostic characters:** *Drimiopsis kikiae* possesses roundish bulbs, a pseudopetiole much shorter than the lamina, a spotted peduncle, and valvate filaments. It is a striking plant possessing a crispate lamina with crenulate purple banded margins. The leaves are a rich deep green, spotted adaxially, and abaxially deep purple. The purple pseudopetiole is shorter than the lamina. The flowers are white. *Drimiopsis kikiae* resembles *D. queae* only in possessing a pseudopetiole and having crenulated leaf margins. There are thirteen differences between the two plants, notably *D. kikiae* has larger leaves that are crispate with undulating margins, abaxially purple tinted and adaxially spotted.

Lebatha and colleagues (2006) have argued in favour of recognition of *Drimiopsis* and *Resnova* as distinct from *Ledebouria* at generic rank based on their thorough studies (Lebatha, 2004). However, molecular cladistic based taxonomies (Manning et al, 2004) have become widely accepted and consequently these genera are often treated within an enlarged *Ledebouria* as for example, in the second edition of the *Illustrated Handbook of succulent plants* (Eggl & Nyffeler 2019).

The requisite combination is here provided:

***Ledebouria kikiae*** (Lebatha) J.M.H.Shaw **comb. nov.**

Basionym: *Drimiopsis kikiae* P.D.Lebatha, *CactusWorld* 39(2):?? (2021).

In cultivation it proves an easy plant if shaded from hot sun, and kept dry and frost-free during winter dormancy, slowly increasing to fill a pot. In the northern hemisphere it flowers in April, after the leaves emerge.

Thank you to Dr Lebatha for agreeing to this publication.

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Julian Shaw

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## Heidi Hartmann and a life with mesembs

Hartmann, W (2020) **Heidrun E.K. Hartmann 1942–2016**. Privately published by Wilfried Hartmann, Hamburg. Hardbound, 120 pages, mainly in English but some reprinted material is in German, illustrated with colour and half tone photos, maps and diagrams.

Heidi Hartmann was a leading expert on mesembs (Aizoaceae) who sadly died in 2016, for whom I wrote the obituary in *CactusWorld* (34: N23, 2016). This book, written by her devoted husband Wilfried, is a tribute to Heidi and her life with mesembs.

Heidi's botanical career began under the tutelage of Prof Hans-Dieter Ihlenfeldt in Hamburg, renowned for his

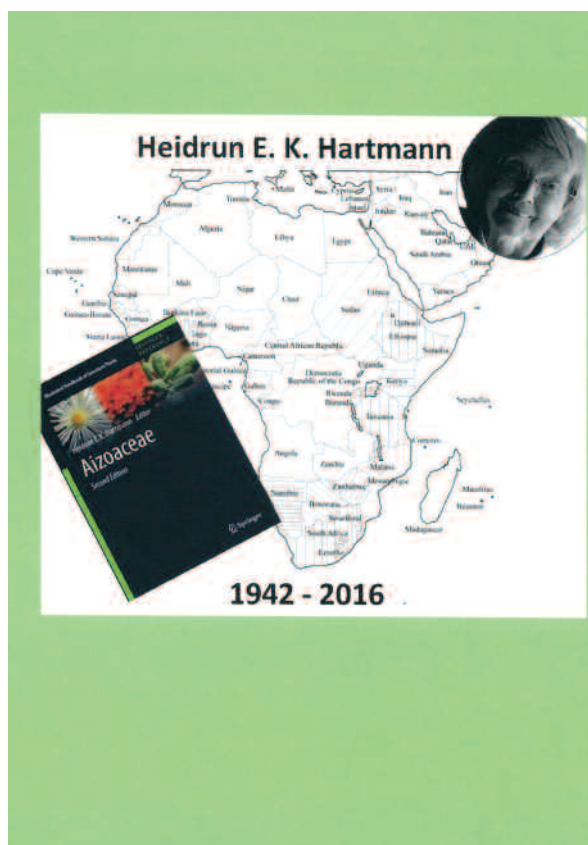


Fig. 8 Cover of the privately published book which is not available to purchase

work on mesemb genera with complex life forms such as *Monilaria*. She studied initially for her PhD on the genus *Argyroderma*, published as a monograph in 1978. This was followed by further monographs of other members of tribe Leipoldtinae: *Cephalophyllum*, *Cheiridopsis*, *Fenestraria*, *Hallianthus*, *Jordaniella*, *Leipoldtia*, *Odontophorus* and *Vanzijlia*. Her life's work culminated in the second edition of the two-volume *Illustrated Handbook of Succulent Plants – Aizoaceae*, published by Springer in 2017 in which a staggering 1312 pages surveyed and summarised all genera of mesembs. Regrettably this work was not completed during Heidi's lifetime since she did not live to see the proof stages. The final proofreading and revision were undertaken by Wilfried who is not a biologist, but he was ably assisted by mesemb specialists.

Wilfried has now told Heidi's life's work in this small book. It includes a cv; a succulent cv and recent topics to study; a full list of her 133 publications (the last three of which were posthumous); tabulation of her teaching career in Hamburg, during which she supervised many PhD students; synopsis of her world-wide travels, both for fieldwork and conferences; international correspondence partners; awards; botanical names in honour of Heidrun Hartmann; membership of scientific organisations; funding sources; Heidrun Hartmann's field of study; scientific exchange; summary of the lecture given in honour of her 75th birthday in 2017; Heidi in news items 1976–2018, and finally reprints of obituaries.

Heidi has left an amazingly long-lasting legacy. The two editions of the two-volume survey of Aizoaceae form a vast testament to her achievements of over four decades of mesemb research. She inspired many mesemb enthusiasts, both professional scientists and amateur growers and students, especially through her support of the UK-based Mesemb Study Group. She is commemorated in the genus *Hartmanthus* and the species *Delosperma heidihartmanniae* and *Gibbaeum hartmannianum* (all Aizoaceae). In 2013 she was awarded the prestigious Cactus d'Or by the Principality of Monaco – an award presented to people who have made an outstanding contribution to the study of succulents. Wilfried's book deals with all of this and provides a fitting tribute to a leading scientist in the world of succulents. She is sadly missed by her huge number of friends and colleagues around the world, myself included.

Colin C Walker

## Dragon trees updated

In the most recent survey of Dragon Trees belonging to the genus *Dracaena*, I accepted eight species as succulent (Walker, 2020), although the genus itself consists of 80+ species in total with a predominantly tropical African distribution.

The most famous of these is *Dracaena draco*, the archetypal Dragon Tree of the Canary Islands and Madeira. This species has been divided into three subspecies: the typical subsp. *draco* occurs on the Canary Islands (Tenerife, Gran Canaria and La Palma) and Madeira; subsp. *ajgal* is endemic to western Morocco and subsp. *caboverdeana* is endemic to the Cape Verde

Islands (Santo Antão, São Nicolau and Fogo). However, I have recently discovered that the status of two of these subspecies has been changed, since they have been elevated to independent species. Subspecies *caboverdeana* became *Dracaena caboverdeana* (Marrerro, Rodr. & R.S. Almeida) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Rivas-Martínez et al, 2017). Also after the publication of my chapter, subsp. *ajgal* became *Dracaena ajgal* (Benebid & Cuzin) Rivas Mart., Molero Mesa, Marfil & G. Benítez (Rivas-Martínez et al., 2020). Neither revised status is discussed nor supported by new or revised data. The original publishing authors proposed and adequately justified subspecific status for their new taxa, so my conclusion is that these should remain as subspecies as the original authors intended.

On checking I have found that these two new names are missing from both the *International Plant Names Index* (IPNI) and *The Plant List* (Kew), so it is not surprising that I missed the publication of *D. caboverdeana*.

I thank Bert Jonkers for notifying me of the obscure Rivas-Martínez et al (2020) publication.

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Colin C Walker

## Molecular phylogeny of the Mammilloid clade

Breslin, Peter B, Wojciechowski, Martin F, Majure, Lucas C, 2021 (Feb 12 online preprint) Molecular phylogeny of the Mammilloid clade (*Cactaceae*) resolves the monophyly of *Mammillaria*. *Taxon* 70(1): 16pp.

Plastid genome sequence data for *Mammillaria*. The genus *Mammillaria* and its allies as currently circumscribed is polyphyletic. A recircumscription of the Mammilloid clade is proposed yielding three monophyletic genera, *Mammillaria* s.str., *Cochemiea* s.l. and *Coryphantha*, plus the validation of 24 new combinations in *Cochemiea*.

### Comments

A handful of molecular studies related to the genus *Mammillaria* and other members of the tribe *Mammillarieae* K.Schum. (1890) have been published in the last 30 years, and here is a further contribution. Having a number of independent molecular studies for the same group facilitates comparisons that may hopefully lead us eventually towards a consensus super-tree phylogeny.

The present new study was undertaken in order to fulfill a presentation for a doctorate from Arizona State University. The resulting phylogeny compiled from the molecular data resolves into three clades that are considered here to each have generic status: *Mammillaria* Haw. nom. cons. (1812,





**Fig. 9** *Cochemiea halei* in habitat on Isla Magdalena, Baja, Mexico (Photo: Peter Breslin)

type *M. mammillaris* (L.) Haw.), *Coryphantha* (Engelm.) Lem. nom. cons. (1868, type *Mammillaria sulcata* Engelm. typ. cons.), and *Cochemiea* (K.Brandegee) Walton (1899, lectotype *Mammillaria halei* K.Brandegee).

*Cochemiea* was adopted as the oldest and therefore priority name for the taxon that includes *Cochemiea halei*, which is true if *Mamillopsis senilis* is excluded, as the author has done. *Mamillopsis senilis* has generally been thought of in the pre-molecular data era as being close to *Cochemiea*. At least one author has combined them. Its morphology is very similar to that of *Cochemiea*. In this study *Mamillopsis* is tucked into the *Mammillaria* clade. *Mamillopsis* is mis-spelt in the article and its year of first description is wrong. The latter is not the author's fault, because he has adopted the mistaken Britton & Rose 1923 reference that has got into wide circulation.

*Mamillopsis* was first described by Ed Morren in 1874 at the rank of genus and section simultaneously, then permitted though it is forbidden today. The rank decision was explained on p.37 of the Morren protologue: "Nous avons donc cru devoir constituer pour elle sinon un genre nouveau au moins une section particulière sous le nom de *Mamillopsis*." [We therefore thought it to be a new genus or at least a section under the name *Mamillopsis*].

Weber, in Bois, *Dictionnaire d'Horticulture* 2(26): 805. (Jan) 1898 proposed the rank of genus, invalidly (Art. 36.1b) in anticipation of future acceptance, but without the realisation that it was already a genus. Weber wrote: "Il vaudrait mieux l'élever au rang de genre et désigner cette plante sous le nom de *Mamillopsis senilis*." [It would be better to elevate it to the rank of genus and give this plant the name of *Mamillopsis senilis*]. Britton & Rose (1923: 19) were equally confused and believed mistakenly that it had originally been proposed as a subgenus. These confused treatments have misled Breslin et al to think that it was not validated until much later.

Breslin et al now place *Mamillopsis senilis* as a sister to *M. prolifera*. However, other molecular studies have indicated the following:

Butterworth (2002): sister to *M. jaliscana* (*Stylotela* or *Bombycinae*)

Butterworth & Wallace (2004): sister to *M. weingartiana* (*Stylotela* or *Bombycinae*)

Arakaki (2005): sister to *M. longiflora* (*Longiflorae*)

Barcenas et al (2011): embedded in the *Stylotela* clade.

Therefore, the placement of *Mamillopsis* by Breslin et al (2021) is completely at odds with the four previous comparable molecular studies. Moreover, the group of species to which *Mammillaria senilis* has now been associated all have lactiferous ducts, whereas *M. senilis* does not. These conflicts have not been addressed.

In the system of Lüthy (1995), *Mammillaria* section *Cochemiea* and section *Mamillopsis* are two of four sections of his concept of subgenus *Cochemiea*. In essence this classification is upheld here, with *Cochemiea* elevated to generic status.

Doweld, in *Cactaceae II, Sukkulenty* 3(1–2): 39. 2000, tried to make *Mamillopsis* a section of *Cochemiea*, which was incorrect because it ought to have been the other way round, but the close affinity of these two taxa was clearly recognised.

Barcenas (2011) had *Cochemiea* as sister to *M. dioica*, which is also in Breslin's *Cochemiea* clade, but rather distant from *Cochemiea* s.str. itself. Arakaki (2005) also had *Cochemiea halei* placed next to *dioica* and *schumannii*.

The article suffers from poor reviewing and proofreading. Spelling and factual errors unfortunately abound. Perhaps the outsourcing of publishing responsibility to an outside private enterprise publisher in recent times has done the journal no favour. Even the title of the article seems to contradict its own content. Surely it should have said that it "resolves the phylogeny (or polyphyly) of..."?

The mistaken idea among cactus botanists that plastid molecular data is all that is required to resolve a phylogeny is repeated again here. Comparative nuclear data is also required in order to identify new lineages initiated by gene sharing. No hybridisation or allopolyploidy has been postulated, although it is certain they exist.

The article wrongly describes *Aulocothele* as a 'segregate' from *Coryphantha*. It is of course an older name and *Coryphantha* had to be conserved in order to stop it from being displaced by a name that had been unused for some 150 years. Source material is primarily of cultivated provenance, and we cannot therefore be very confident that identification errors have not been made.

It seems so much easier just to leave everything in *Mammillaria*!

Roy Mottram

## Correction

The author Holger Wittner, wishes to point out an error in the last *CactusWorld* 39(1): 18. In the first paragraph, the third sentence is incorrect, and it should read:

'One such article (Cieza, 2010) refers to some red-flowered specimens as *M. intertexta* × *aureiflora*, but this author does not recognise those plants as hybrids.'